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Research Article

Estimation of Serum Ferritin and Complete Blood Count among Tuberculosis Patients Attending Kosti teaching hospital, White Nile state, Sudan

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Abstract

Introduction: Iron deficiency (ID) is the most common cause of nutritional deficiency anemia in the developing world and complete blood count (CBC) is one of the most common blood tests that used to diagnosis of hematological abnormalities. Also, serum Ferritin is more sensitive test used to evaluate and reflect iron status in our body. Tuberculosis is a major of a big health problem in the world especially in Sudan, this study done in Kosti teaching hospital during June to September 2018.

Study design: Case con this study. Fifty patients infected with tuberculosis were selected as cases and fifty normal people (without TB) have been matched as control groups.

Methodology: 2.5 ml blood samples were taken in ethylene diamine tetra acetic acid (EDTA) treated tube and were analyzed in Mindray BC-3000 automated hematology analyzer. Biosystem BTS-350 spectrophotometer protocol has been used for Ferritin measurement. ESR was read using Westergren tube method.

Result: The results showed highly significance in all hematological parameters in TB patients when compared with the healthy person and the P value were 0.000 in all parameters, 0.01 in the Hb. Also, patients with normal and high serum Ferritin were detected (17 with normal value and 23 have a high serum Ferritin) and less than 10 cases low serum Ferritin those suffering from iron deficiency anemia. The ESR values of TB patients obtained in this study were significantly higher than control values.

Conclusion: Most of the patients were anemic with low Hb and RBCs indices. The study found a strong positive association of anemia without iron deficiency and TB (23 cases with high serum Ferritin and 10 cases with low serum Ferritin), suggesting that factors other than iron deficiency also contribute to the association of anemia with poor outcomes may be due to chronic infection.

Keywords: Complete blood count; Tuberculosis; ethylene diamine tetra acetic acid

Abbreviations: CBC: Complete blood count; TB: Tuberculosis; EDTA: Ethylene diamine tetra acetic acid; Hb: Hemoglobin; ACD: Anemia of chronic disease; ID: Iron deficiency; SF: Serum Ferritin; CD: Chronic disease; ESR: Erythrocyte sedimentation rate

Introduction

Iron deficiency (ID) is the most common cause of nutritional deficiency anemia in the developing world [1]. There is also a high incidence of various chronic illnesses such as tuberculosis in this population. The incidence of tuberculosis is as high as 1/1000 in our population [2]. It is important to establish the presence of ID in these patients of tuberculosis and other chronic inflammatory or infectious diseases, as even mild iron deficiency causes a significant impairment in the immunological status and reduces the capacity of such patients to control infections. This is of special importance in developing countries because iron deficiency, if established in these patients, could be corrected with cheap iron supplementation that would not only improve anemia but also influence the clinical outcome of the infectious disease [3]. Determination of conventional hematological indices and biochemical variables is of little help in demonstrating iron deficiency in these patients as they are similarly affected in both ID and anemia of chronic disorders (ACD) [4,5]. Bone marrow examination for iron is the gold standard for detecting ID in such conditions. Being an invasive procedure, it causes patient discomfort and anxiety. Hence, serum Ferritin (SF), a non-invasive parameter reflecting iron stores, is being extensively studied. SF 10 g/l is diagnostic of absent bone marrow iron stores in any clinical setting [4,5]. However, SF is an acute phase reactant and is increased in inflammations and infections. In most cases of CD, SF is disproportionately increased relative to iron stores [6,7]. In such a clinical setting of CD it is, therefore, not reflective of bone marrow iron. To compensate for this inflammatory component, many authors have suggested higher cut-off values, predictive of ID in patients with anemia of chronic disorders [8-10].

Fe-deficiency anaemia is the most common cause of anaemia in developing countries. And many chronic infections, including tuberculosis (TB), are highly prevalent. Fe is an essential nutrient for both host and mycobacteria that play a pivotal role in host immunity and mycobacterial growth. Fe is an essential component of Hb, as Fe binds and transports O2. Several lines of evidence have suggested that iron is critical for Mycobacterium tuberculosis growth in macrophages.

Iron deficiency is considered the most important contributor to the development of anemia worldwide, but other causes often coexist. If iron deficiency were established as an important contributor to TB associated anemia, the targeted provision of supplemental iron may be used to increase blood hemoglobin concentrations and improve clinical outcomes in TB patients. The contribution of iron deficiency without anemia to TB disease progression may also be of direct importance, because iron deficiency has been associated with impaired immune function and reduced capacity to control infection.

Complete Blood Count (CBC) is the routine investigation done for patient irrespective of the type of infection that provides important information about the kinds and numbers of cells in the blood, especially red cells, white cells and platelets and provides much needed information for making decision of treatment.

The objective of the present study was to describe the prevalence of anemia and of its types in hospitalized patients with pulmonary tuberculosis, as well as to examine the relationship between anemia and the clinical and nutritional status of anemic patients in comparison with non-anemic patients (controls).

Materials and Methods

Study design: Case Control study.

Study population

Inclusion Study: For Patient: Known patients with Acid fast bacilli ZN stain +ve smear.

For control: Healthy person with Acid fast bacilli ZN stain -ve smear.

Exclusion Study: For Patient: Known patients with Acid fast bacilli ZN stain -ve smear.

For control: Person with Acid fast bacilli ZN stain +ve smear.

Study area: Kosti teaching hospital, White Nile state, Sudan.

Sample size: 100 Venous blood samples50 blood samples from patients infected with TB and 50 blood samples from healthy persons as control.

Data collection method: Data collected by using structural interviewing questionnaire.

Ethical Consideration: All participants were completed an individual informed consent form.

Data analysis: Data were analyzed using the Microsoft Excel program and SPSS version21 was used for data entry and analysis. The *p.value* less than 0.05 consider significant.

Materials

During the study, the following equipments and materials were used: syringes. Cotton, EDTA containers, Mindray BC-3000 automated hematology analyzer, Racks, the method for measurement of Ferritin on the Biosystem BTS-350 spectrophotometer by using Biosystem reagent. ESR was read using Westergren tube method. All results sited in the questioner.

Results

One hundred Venous blood samples,50 from patients infected with TB attending Kosti teaching hospital were matched with 50 from healthy individuals as control (without TB), were analyzed for hematological parameters change using automated hematological analyzers method (Mindray BC-3000) and the method for measurement of Ferritin on the Biosystem BTS-350 spectrophotometer by using Biosystem reagent, ESR were read using Westergren method.

The result was processed statistically by using SPSS (version21). The following tables showed the results obtained.

Discussion

Pulmonary tuberculosis is a major infectious disease with very high incidence in developing countries. This is a case control study conducted in Kosti teaching hospital in White Nile State, Sudan, from June to September 2018 to reveal change in hematological profile and serum Ferritin in pulmonary tuberculosis patients who is clinically positive with acid fast bacilli in sputum. The patients were lies in average of ages between 15-30 years, 31-45 years and <15 years and 31cases of patients had a family history of TB.

Our present study show haemoglobin concentration, packed cell volume, mean cell volume and mean cell haemoglobin of pulmonary tuberculosis patients (9.93±1.827, 31.3±5.27, 79.63±8.85, 25.6±3.61) respectively, was significantly lower ($p<0.05$) than that of control subjects (12.95±1.728, 39.22±3.50, 87.4±4.20, 28.72±1.76) ,while RBC count and MCHC of patients was found normal (3.92±0.735, 31.88±1.38) near to that of control subject **(**4.55±0.400,32.7±0.93**)** **Table 1.**

Table 1: Distribution Of patients based on Histopathological grading	
Histopathological Grade	Total
Well Differentiated	68
Moderately differentiated	55
Poorly differentiated	19
Total	142

These finding is agree with result of Mubarak I Idriss, et al., that was done on Kassala Area, Eastern Sudan on August 2013, who found that sixty three (63%) with haemoglobin between 7g/dl and11g/dl, (9.2%) with haemoglobin less than 7g/dl. 26 (26.5%) of the patients with haemoglobin more than 11g/dl, MCV 70.6 ± 9.5fl, MCH 25.3 ± 4.6pg, MCHC 35.8 ± 3.6g/dl and RBC count 4 471 000 ± 9 517.

Concerning RDW value in PTB patients (16.06±2.66) were found in our current study, significantly higher when compared with control one (13.58 ±0.9) (*p.value*=0.000). This result similar to those finding of a Gribel M and her

colleagues which done in the state of Rio de Janeri between March 2007 and December of 2010 and concluded that high RDW (16.63± 3.47%) **Table 2**.

Table 2: Showing Prevalence of level V LN in various clinical stages

Clinical stage	Number of patients	Level V lymph node-positive	Prevalence
cN0	38	0	0
cN1 (level I)	54	1	1.8%
cN1 (level II/III)	22	1	4,5 %
cN2	28	5	17%
total	142	7	4.9%

On the study done by Muhammad Shafee and his colleagues Platelets count was found in the normal range in most of the patients, however thrombocytopenia. This finding is consistant with our study which shows normal platelet count in 39 of cases, thrombocytopenia in 11 of cases.

The prevalence of leukocyte count in present study was coinciding to study done by Iqbal and his colleagues in Military Hospital, Rawalpindi. Neutrophilia and Eosinophilia is reported in (15 cases, 12 cases respectively) of patients, monocytosis in (26) of cases, and low lymphocyte count in (37) of cases. This result agree in points and disagree in another point with various studies, like neutrophilia documented by Iqbal and his colleagues in Military Hospital, Rawalpindi different from our result may due to improving of patient status with successful treatment.

Comparing with study done by Bala J. and his colleagues in India at 2015 our findings in patients in case of lymphocyte count are matched, but concerning with Eosinophil count mis matched results were obtained, Bala J. and his collageous, documented normal Eosinophil count in 92.5% of patient. In the present study, the proportion of patients with anemia of chronic disease was higher than was that of those with iron-deficiency anemia (40 vs10), a finding that was agreement to those reported in other studies done by Lee SW, Kang YA in Koran. But different from those reported in another study done by Sahiratmadja E, Wieringa FT in Indonesia. Ferritin levels is the most sensitive method for the diagnosis of iron deficiency.

Given that microcytosis was observed in most of the patients in the present study, increased RDW and decreased level of MCV might be useful to demonstrate iron deficiency. This agree with are similar study done by- Monteiro L.Valoresdere. This study, however, has several limitations. First, we defined iron deficiency in this population using MCV. MCV reflects the mean RBC volume and has been the most widely used index for the evaluation of nutritional iron deficiency. Low MCV, however, is not specific to iron deficiency and can result from other causes, including Thalassemia and, less commonly, anemia of chronic disease. Low MCV in this population may be well correlated with iron deficiency, but this cannot be confirmed with the data available. Biochemical measures more specific to iron deficiency, such as Ferritin. In the present study found high serum Ferritin in 23 cases and low in 10 cases this agree with study done by Morris et al., found increased iron stores in 81% and low in 19% of their patients with pulmonary tuberculosis.

In the present study, the proportion of patients with anemia of chronic disease was higher than was that of those with iron-deficiency anemia (40 cases vs. 10 cases), a finding that was similar to those reported in other studies but different from those reported in another study.

The ESR values of PTB patients (69.07± 17.68 mm/hr) obtained in this study were significantly higher than control values (20.71±4.80 mm/hr). This agrees with previous findings which stated that high ESR (60.30± 39.84**)**. ESR is often raised in infections and inflammatory conditions due to increased production of acute phase proteins often observed in chronic infections and release of proteins by the causative organism (*M.tuberculosis)* into the circulation.

To our knowledge, this is the first study done in my country to relate serial measures of anemia and iron deficiency with the risk of poor clinical outcomes in TB.

Conclusion

We found a positive association of anemia with iron deficiency with TB (10 cases). Suggesting that factors other than iron deficiency also contribute to the association of anemia with poor outcomes. One possible explanation for this finding is that anemia without iron deficiency in this study is due to factors associated with poor health status or advanced disease (TB).

Recommendations

Iron supplementation is recommended for the treatment of iron deficiency anemia to (10 cases in our study). Also recommended Bone marrow examination for iron because BM is the gold standard for detecting iron and also to differ iron deficiency anemia from other type of anemia.

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